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PATENT

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IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicants: Johan ULIN et al.  
Int'l Application No.: PCT/SE2003/001996  
Application No.: **NEW APPLICATION**  
Filed: June 15, 2005  
For: VESSEL FOR PERFORMING MICROWAVE-ASSISTED  
CHEMISTRY O SMALL VOLUMES OF REAGENTS

**LETTER**

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June 15, 2005

Sir:

Amended sheets are attached hereto (which correspond to Article 34 amendments or to claims attached to the International Preliminary Examination Report), as required by 35 U.S.C. § 371(c)(3). The Article 34 amended sheets are incorporated in the included substitute specification and Preliminary Amendment.

Respectfully submitted,

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## CLAIMS (2005-01-03)

1. A micro vial assembly for performing microwave-assisted chemical reactions on small volumes, the assembly comprising:
  - a micro-wave transparent reaction vessel (10) having an open upper end and a closed bottom end;
  - a cap (40) having a through hole, and a sealing diaphragm (30), wherein a sleeve (20) is formed with a through hole, the vessel extending axially through the sleeve and the cap securing the vessel to the sleeve while clamping the diaphragm for sealing the open upper end of the vessel, the open upper end of the vessel being formed with a widening portion (14,15,16), the widening portion being received in a corresponding recess formed in an end plane of the sleeve, the recess providing a seat (24) for the widening portion in the open upper end of the vessel.
2. The micro vial assembly of claim 1, wherein the upper end of the sleeve is formed circumferentially for engagement with the cap, the sleeve having a first diameter portion (D<sub>1</sub>) running from the upper end to meet a reduced diameter portion (D<sub>2</sub>) in the lower end of the sleeve.
3. The micro vial assembly of claim 2, wherein the portion of reduced diameter in the lower end of the sleeve is a truncated cone.
4. The micro vial assembly of claim 1, wherein the widening portion of the vessel (10) and the seat (24) in the end plane of the sleeve (20) are both conical in shape.
5. The micro vial assembly of any previous claim, wherein the open end of the vessel (10) is defined by a rim (16) protruding above the upper end of the sleeve (20) when the vessel is supported in the sleeve, the rim being dimensioned to be depressed in the lower side of the diaphragm (30).
6. The micro vial assembly of claim 5, wherein the rim (16) has an inner perimeter extending transversely to the diaphragm (30), sealing the open end of the vessel.
7. The micro vial assembly of claim 6, wherein the inner perimeter of the rim (16) defines a portion of the vessel cavity having a first radius r<sub>1</sub>, said first radius

portion meeting a second portion of reducing radius  $r_2$ , the reducing radius portion smoothly transforming into a portion of continuous radius  $r_3$  defining a reaction chamber of the vessel cavity.

8. The micro vial assembly of any previous claim, wherein a bottom of the vessel (10) is formed through a radial compression (12) of the vessel, located above the terminal end (13) of the vessel.

9. The micro vial assembly of any previous claim, wherein the vessel (10) has an inner volume including a head-space volume which is less than 20 times that of the smallest reaction mixture volume contained in the vessel.

10. The micro vial assembly of any previous claim, wherein the vessel (10) is dimensioned for performing microwave-assisted chemical reactions on small volumes of 500  $\mu\text{l}$  or less.

11. A system for performing microwave-assisted chemical reactions on small reaction mixture volumes, comprising a micro vial assembly (10,20,30,40) according to any previous claim 1-10.

12. The system of claim 11, wherein the outer perimeter of the sleeve (20) is dimensioned for bridging the radial distance between a wall of the vessel (10) and an entrance diameter (D) of a microwave cavity (1) in the system.

13. The use of a micro vial assembly according to any of claims 1-10 for performing microwave-assisted chemical reactions, in particular microwave-assisted organic synthesis reactions.

14. The use of a system according to any of claims 11-12 for performing microwave-assisted chemical reactions, in particular microwave-assisted organic synthesis reactions.

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3/3

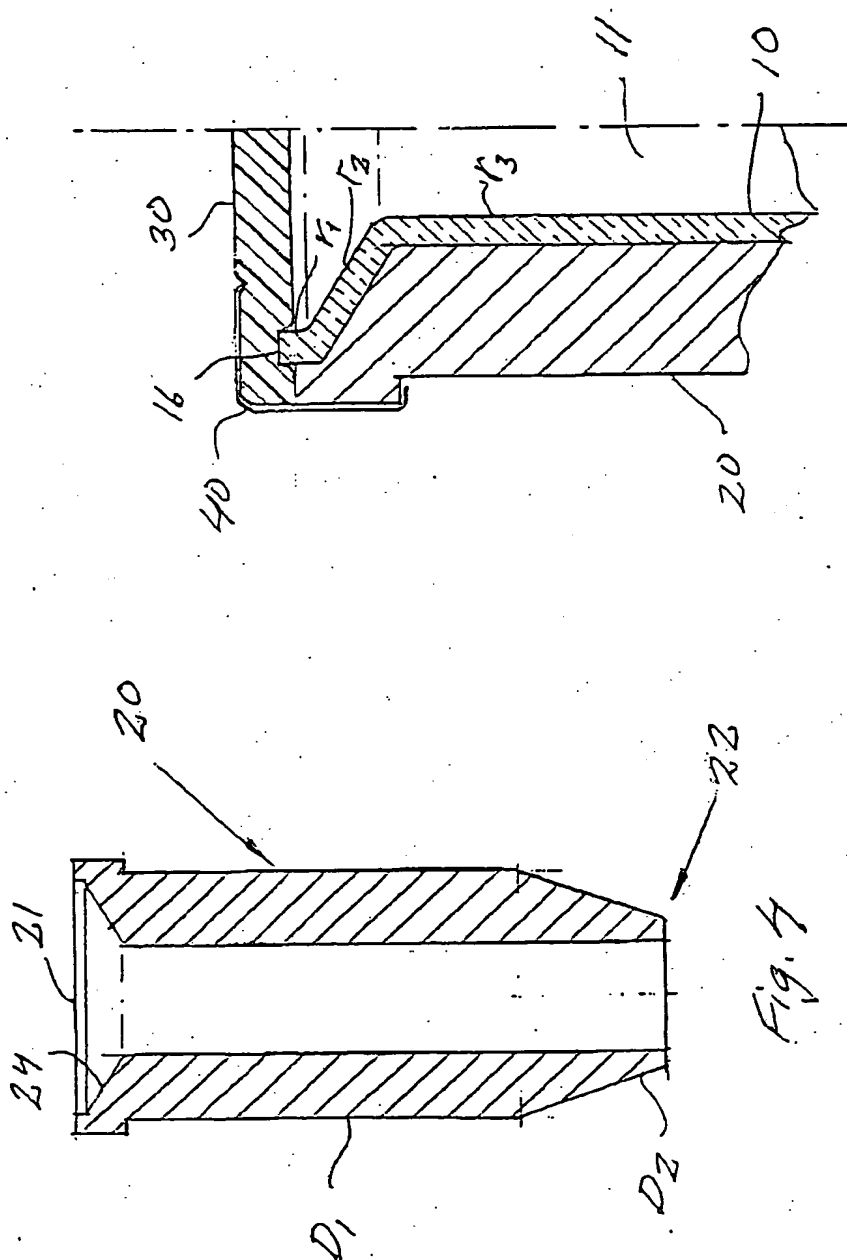


Fig. 5

Fig. 4

CLAIMS (2005-01-03)

1. A micro vial assembly for performing microwave-assisted chemical reactions on small volumes, the assembly comprising:
  - a micro-wave transparent reaction vessel (10) having an open upper end and a closed bottom end;
  - a cap (40) having a through hole, and a sealing diaphragm (30), wherein a sleeve (20) is formed with a through hole, the vessel extending axially through the sleeve and the cap securing the vessel to the sleeve while clamping the diaphragm for sealing the open upper end of the vessel, the open upper end of the vessel being formed with a widening portion (14,15,16), the widening portion being received in a corresponding recess formed in an end plane of the sleeve, the recess providing a seat (24) for the widening portion in the open upper end of the vessel.
2. The micro vial assembly of claim 1, wherein the upper end of the sleeve is formed circumferentially for engagement with the cap, the sleeve having a first diameter portion ( $D_1$ ) running from the upper end to meet a reduced diameter portion ( $D_2$ ) in the lower end of the sleeve.
3. The micro vial assembly of claim 2, wherein the portion of reduced diameter in the lower end of the sleeve is a truncated cone.
4. The micro vial assembly of claim 1, wherein the widening portion of the vessel (10) and the seat (24) in the end plane of the sleeve (20) are both conical in shape.
5. The micro vial assembly of any previous claim, wherein the open end of the vessel (10) is defined by a rim (16) protruding above the upper end of the sleeve (20) when the vessel is supported in the sleeve, the rim being dimensioned to be depressed in the lower side of the diaphragm (30).
6. The micro vial assembly of claim 5, wherein the rim (16) has an inner perimeter extending transversely to the diaphragm (30), sealing the open end of the vessel.
7. The micro vial assembly of claim 6, wherein the inner perimeter of the rim (16) defines a portion of the vessel cavity having a first radius  $r_1$ , said first radius

portion meeting a second portion of reducing radius  $r_2$ , the reducing radius portion smoothly transforming into a portion of continuous radius  $r_3$  defining a reaction chamber of the vessel cavity.

8. The micro vial assembly of any previous claim, wherein a bottom of the vessel (10) is formed through a radial compression (12) of the vessel, located above the terminal end (13) of the vessel.

9. The micro vial assembly of any previous claim, wherein the vessel (10) has an inner volume including a head-space volume which is less than 20 times that of the smallest reaction mixture volume contained in the vessel.

10. The micro vial assembly of any previous claim, wherein the vessel (10) is dimensioned for performing microwave-assisted chemical reactions on small volumes of 500  $\mu$ l or less.

11. A system for performing microwave-assisted chemical reactions on small reaction mixture volumes, comprising a micro vial assembly (10,20,30,40) according to any previous claim 1-10.

12. The system of claim 11, wherein the outer perimeter of the sleeve (20) is dimensioned for bridging the radial distance between a wall of the vessel (10) and an entrance diameter (D) of a microwave cavity (1) in the system.

13. The use of a micro vial assembly according to any of claims 1-10 for performing microwave-assisted chemical reactions, in particular microwave-assisted organic synthesis reactions.

14. The use of a system according to any of claims 11-12 for performing microwave-assisted chemical reactions, in particular microwave-assisted organic synthesis reactions.

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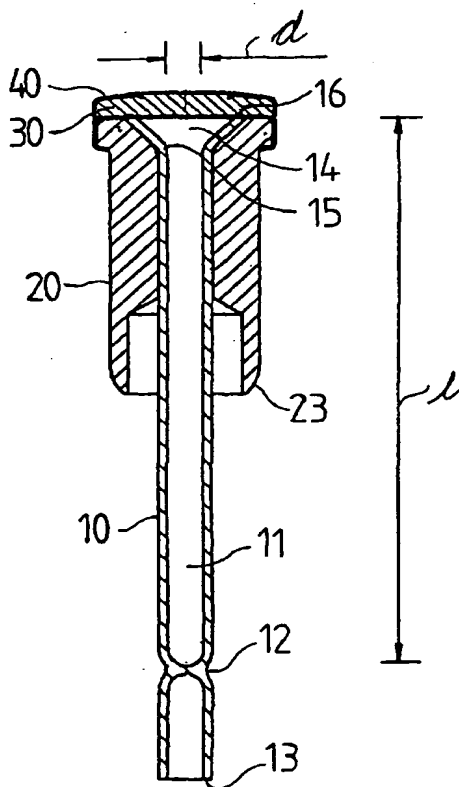
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(54) Title: VESSEL FOR PERFORMING MICROWAVE-ASSISTED CHEMISTRY ON SMALL VOLUMES OF REAGENTS



(57) Abstract: A micro vial assembly for performing microwave-assisted chemical reactions on small reaction mixture volumes is disclosed, wherein a reaction vessel (10) is sealed through a diaphragm (30) that is capped over an open end of the reaction vessel. The reaction vessel mouths in an end plane of a sleeve (20) surrounding the reaction vessel, the diaphragm being clamped for sealing the open end of the vessel by means of a cap (40) which is secured to the sleeve. The sleeve provides a radial extension of the reaction vessel in order to bridge the radial distance between a wall of the reaction vessel and other components in a system for performing microwave-assisted chemical reactions.

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